



Maintenance of Traffic



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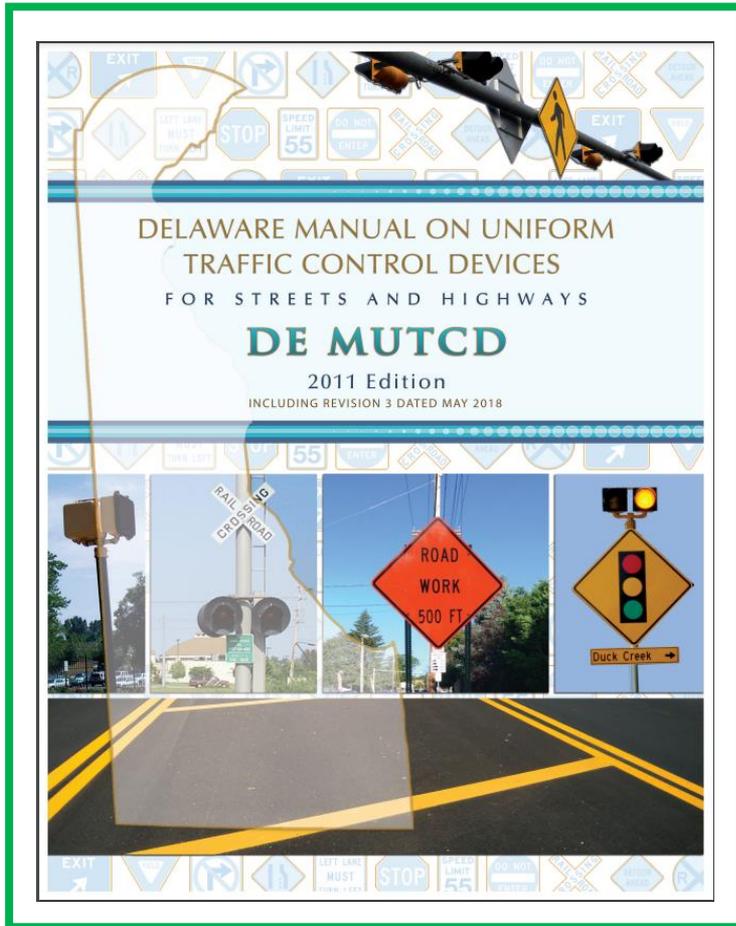


**WALLY
THE WORK ZONE
WARRIOR**

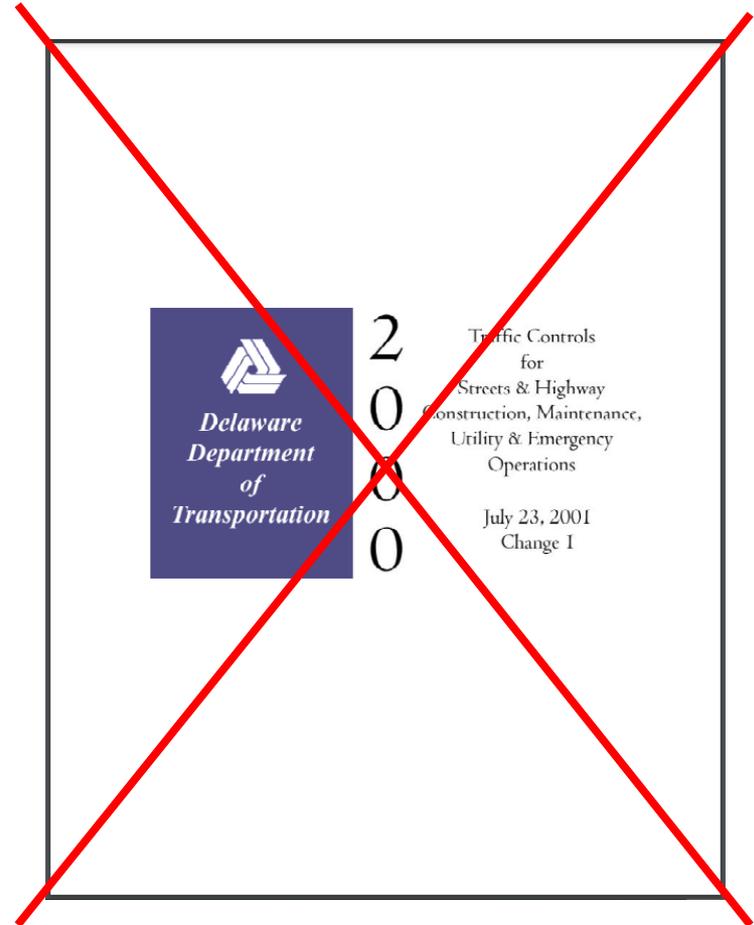
Maintenance of Traffic



Maintenance of Traffic



www.mutcd.delaware.gov



Maintenance of Traffic

- General Items to include on all Entrance/Construction plans:
 - ✓ Maintenance of Temporary Traffic Control Notes (latest version)
 - ✓ Allowable Lane Closure Hours (provided by DeIDOT)
 - ✓ Sequence of Construction
- Items that may be required based on project scope and site-specific conditions:
 - ✓ Site-Specific MOT Plans and Details
 - ✓ Pedestrian MOT

General Items

- Maintenance of Temporary Traffic Control Notes
 - NOTES UPDATE
 - Revised language in several existing notes for consistency with the Standard Specifications
 - For example...

OLD NOTE

1. All temporary traffic control and temporary traffic control devices shall be in accordance with: the contract documents, the latest version of the Delaware Manual on Uniform Traffic Control Devices (hereinafter referred to as the “Delaware MUTCD”), current State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, and Supplemental Specifications, including all revisions as of the date of the entrance permit approval.

NEW NOTE

1. All temporary traffic control and temporary traffic control devices shall be in accordance with: the contract documents, the latest version of the Delaware Manual on Uniform Traffic Control Devices (DE MUTCD), current State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, and Standard Construction Details, including all revisions as of the date of the entrance permit approval. Temporary Traffic Control Devices used on the project shall only be those listed on the Approved Products List (APL). If a category of devices does not have an APL, the device shall be compliant with the DE MUTCD.

General Items

- Maintenance of Temporary Traffic Control Notes
 - NOTES UPDATE
 - Added new notes
 - For example...

Lane closures and road closures are prohibited from occurring during the Firefly Music Festival event in Dover, DE from 12:00 AM Wednesday prior to the event through 12:00 AM Tuesday following the event. The engineer will provide the dates of the event two weeks prior to the restriction being implemented.



General Items

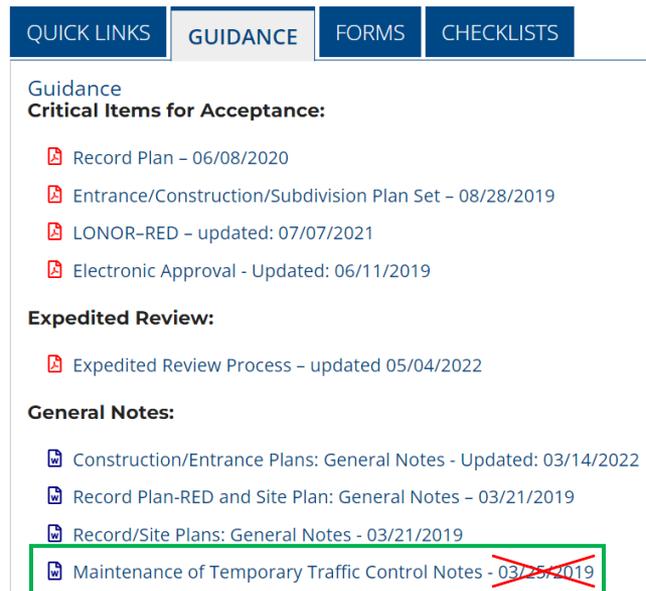
- Maintenance of Temporary Traffic Control Notes
 - NOTES UPDATE

Place the following notes on the Plan IF they apply to your project:

15. The Contractor shall add the Bicycle In Lane (W11-1-DE) sign to the typical application signing stack during construction activities that restrict use of the existing shoulder/bike lane. When used, the sign shall have a black legend on a retroreflective fluorescent orange background.
16. Construction activities that impact traffic signal operation shall follow the Temporary Traffic Control within Intersections memo dated May 17, 2022 (see www.mutcd.deldot.gov).
17. All necessary signs, pavement markings, and roadside appurtenances shall be installed prior to the opening/reopening of a roadway or ramp. A walkthrough with the Engineer, Traffic Safety, Traffic Construction, and other personnel shall occur no less than 48 hours prior to the opening/reopening of any road or ramp. Deficiencies noted during the walkthrough shall be corrected prior to the opening/reopening of any road or ramp. *(Use note when directed by Traffic Safety)*
18. Additional lane restrictions will be enforced by the Engineer, in consultation with the District Safety Officer, to accommodate permitted Planned Special Events through the work zone. Known events that could impact this project include XXXX. The Engineer will notify the Contractor of additional lane restrictions two weeks prior to the start of the restriction. *(Use note when directed by Traffic Safety. Traffic Safety will identify the events)*

General Items

- Maintenance of Temporary Traffic Control Notes
 - Frequently Seen Errors
 - Not using the current version of the notes
 - Use latest version posted on DelDOT's Development Coordination website:
<https://deldot.gov/Business/subdivisions/#guidancetab>



QUICK LINKS | GUIDANCE | FORMS | CHECKLISTS

Guidance

Critical Items for Acceptance:

- Record Plan – 06/08/2020
- Entrance/Construction/Subdivision Plan Set – 08/28/2019
- LONOR-RED – updated: 07/07/2021
- Electronic Approval - Updated: 06/11/2019

Expedited Review:

- Expedited Review Process – updated 05/04/2022

General Notes:

- Construction/Entrance Plans: General Notes - Updated: 03/14/2022
- Record Plan-RED and Site Plan: General Notes – 03/21/2019
- Record/Site Plans: General Notes - 03/21/2019
- Maintenance of Temporary Traffic Control Notes - ~~03/25/2019~~

General Items

- Maintenance of Temporary Traffic Control Notes
 - Frequently Seen Errors
 - Not using the correct typical applications in MOT note #10
 - See Part 6 of the DE MUTCD
 - Cases = old terminology
 - Typical Applications = current terminology
 - Use the correct TA for the roadway type
 - TA-6 is only to be used on minor roads with low speeds such as subdivision streets; use TA-10 on all other roadways
 - Identify the TA using the same language in the DE MUTCD

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DE MUTCD

Notes for Figure 6H-3A—Typical Application 3A

Work on the Shoulder of a Multi-Lane, Divided Highway

(Delaware Revision)

Guidance:

1. A SHOULDER CLOSED sign should be placed on the left side of the roadway for a divided or one-way street only if the left shoulder is affected.

Option:

2. The SHOULDER CLOSED sign may be omitted from an intersecting roadway where drivers emerging from that roadway will encounter another advance warning sign prior to the activity area.

3. For short duration operations of 60 minutes or less, all signs and channelizing devices may be eliminated if a vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.

General Items

- Interim Guidance, TA-26A: Closure at a One-Lane Roundabout

Notes for Figure 6H-26A—Typical Application 26A
Closure at a One-Lane Roundabout
(Delaware Revision)

Support:

1. Each roundabout is unique, and the traffic control must be developed to meet the specific conditions of the location and the work operation. A detour could possibly better serve traffic movement and may be considered as an alternative to the flagger operation depicted in Figure 6H-26A with the approval of DelDOT Traffic.

Standard:

2. Flaggers shall control traffic flow on all approaches of the one-lane roundabout.
3. At night, flagger stations shall be illuminated, except in emergencies.
4. A lead flagger shall be designated, and approved communication devices shall be used by all flaggers.
5. Portable Changeable Message Signs (PCMS) shall be used on any approach where traffic is required to move to the left or right of a splitter island. PCMS messages shall be approved by DelDOT Traffic.

Support:

6. Suggested PCMS messages are shown in Figure 6H-26A.

Option:

7. A BE PREPARED TO STOP sign may be added to the sign series.

Guidance:

8. When used, the BE PREPARED TO STOP sign should be located between the Flagger symbol (or FLAGGER AHEAD) sign and the ONE LANE ROAD sign.
9. Where drivers emerging from an intersecting roadway will not encounter an advance warning sign prior to the work zone, additional signs should be placed on the intersecting road.
10. Maximum possible stopping sight distance should be provided approaching each flagger station (see Table 6C-2).
11. The buffer space should be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.
12. Accommodations for the turning radius of tractor trailer vehicles and other large vehicles should be considered when laying out the channelizing devices for this typical application.

Option:

13. A supplemental flagger may be used in the roundabout island to help direct traffic.

Standard:

14. For long-term, intermediate-term, and short-term operations, a truck-mounted attenuator shall be used on roadways with a posted speed limit or 85th-percentile speed greater than 40 mph.

Option:

15. For short duration operations of 15 minutes or less along roadways with a posted speed limit or 85th-percentile speed greater than 40 mph, a truck-mounted attenuator may be omitted if a vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.
16. Truck-mounted attenuators may be used for all operations along roadways with a posted speed limit or 85th-percentile speed less than or equal to 40 mph.

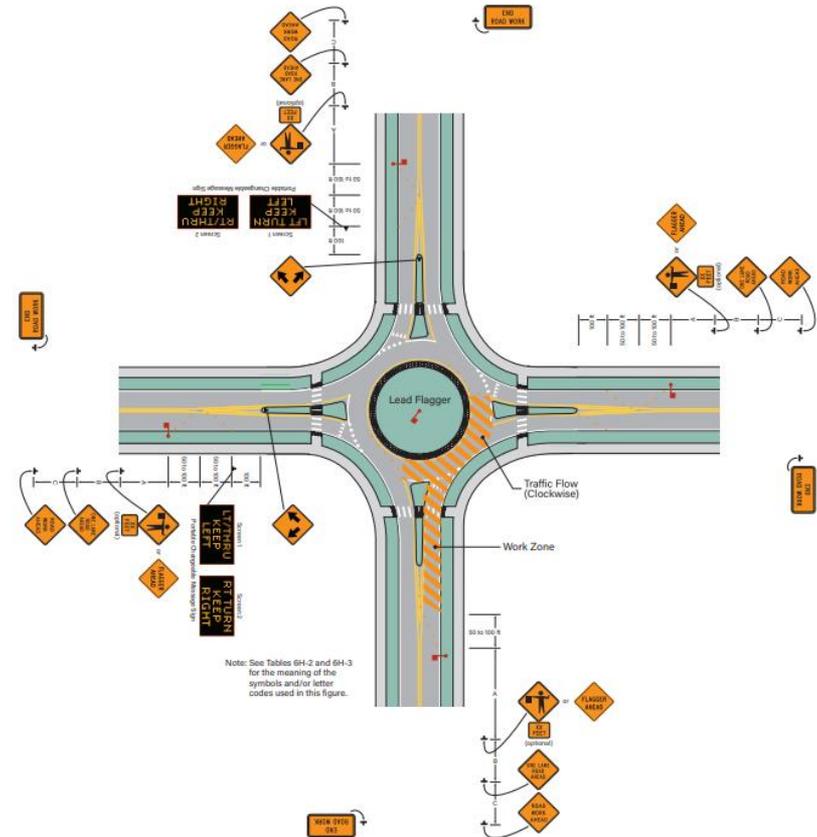
Guidance:

17. When working within two or more quadrants of the circulatory roadway, the intersection should be closed and traffic detoured around the closure, following the principles of TA-20.

Standard:

18. If used, a detour shall be approved by DelDOT Traffic.

Figure 6H-26A. Closure at a One-Lane Roundabout (TA-26A)
(Delaware Revision)



TA-26A: Closure at a One-Lane Roundabout

General Items

- Allowable lane closure hours matrix
 - The matrix is provided by Traffic Safety during the first formal Entrance/Construction plan submittal
 - Specifies the times of day the Contractor is allowed to close travel lanes and/or turning lanes
 - Does not apply to shoulder closures
 - When applicable, designers to obtain concurrence from the Town or Municipality



General Items

- Allowable lane closure hours matrix

SR 1 / Coastal Highway Allowable Lane Closure Hours
Non-summer (October 1 - April 30)

	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
SUNDAY																								
MONDAY																								
TUESDAY																								
WEDNESDAY																								
THURSDAY																								
FRIDAY																								
SATURDAY																								

 bus/bike/right-turn lane closure in accordance with TA-3A permitted
 no lane closures (all lanes open)

If two matrices are provided (summer and non-summer), include both on the plans

SR 1 / Coastal Highway Allowable Lane Closure Hours
Summer (May 1 - September 30)

	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
SUNDAY																								
MONDAY																								
TUESDAY																								
WEDNESDAY																								
THURSDAY																								
FRIDAY																								
SATURDAY																								

 bus/bike/right-turn lane closure in accordance with TA-3A permitted
 no lane closures (all lanes open)

Shade and add X's to applicable cells

General Items

- Sequence of Construction
 - Will range from one simple phase to multiple phases with phasing plans depending on the scope of the project
 - Detail the entrance work taking place in the order that it is to occur



General Items

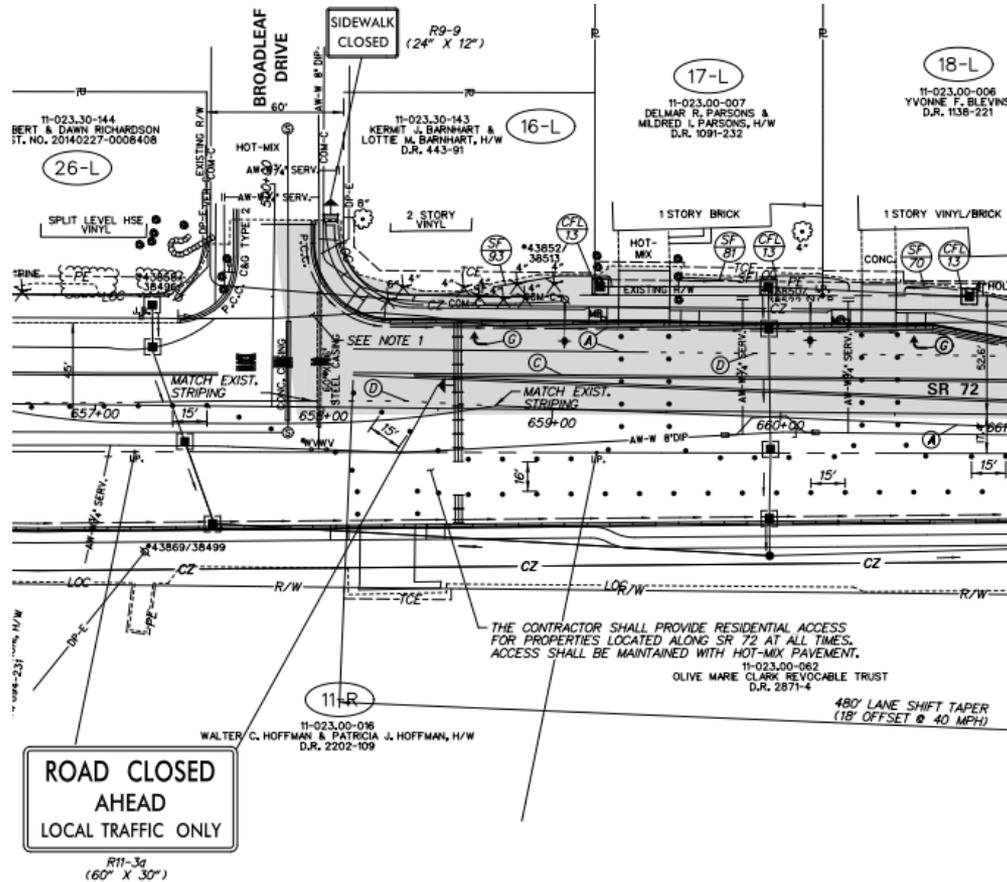
- Sequence of Construction: Order of work
 - Utility and drainage work typically occur first
 - Ensure positive drainage is maintained throughout construction
 - Install base paving up to the type B paving layer, mill (if applicable), then place final type C wearing coarse in a single operation.



Milled (grooved pavement) causes instability for motorcycles and bicyclists, which can contribute to loss of control. Decrease the duration of the hazard to improve safety.

General Items

- Sequence of Construction



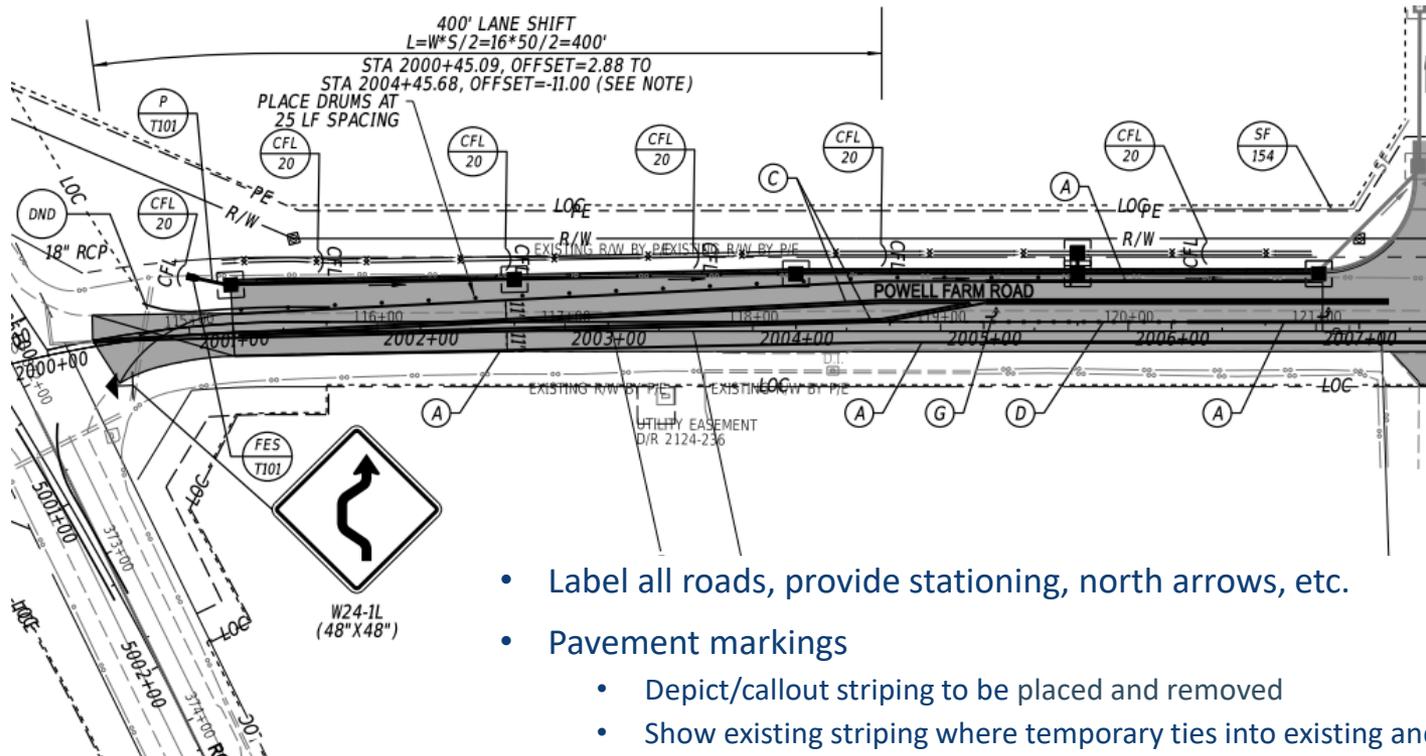
Local access shall be maintained throughout construction

General Items

- Sequence of Construction: Other Items to Include
 - Signal work
 - Specify items to be installed by DeIDOT Traffic vs Contractor
 - Specify coordination with DeIDOT Traffic for installation or modification of above ground signal equipment and activation of signals
 - Detours
 - Specify installation and removal of detours
 - Consider detour duration to limit inconvenience to the traveling public
 - Pedestrian/bike
 - Sequence work to account for continued use of pedestrian signals at signalized pedestrian crossings
 - Roadway
 - Only include the work that must occur under detour as taking place during the detour
 - Guardrail
 - Positive protection shall be provided during guardrail work and shall remain in place until the hazard is removed / guardrail is fully functional

Site-Specific MOT Plans and Details

- Provide site-specific MOT plan(s) when the MOT does not conform to a Typical Application and/or existing lane configurations are not restored at the end of each work day.

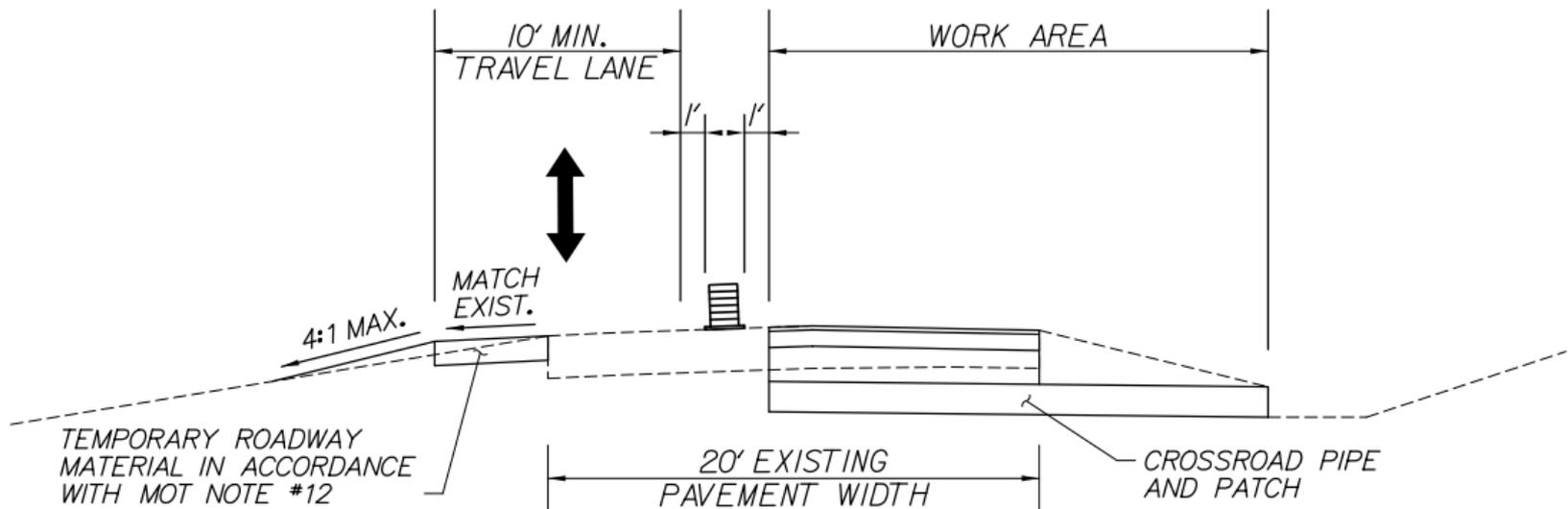


- Label all roads, provide stationing, north arrows, etc.
- Pavement markings
 - Depict/callout striping to be placed and removed
 - Show existing striping where temporary ties into existing and label
 - Durations > 30 days, consider “permanent” striping items to minimize repainting and maintenance needs

Site-Specific MOT Plans and Details

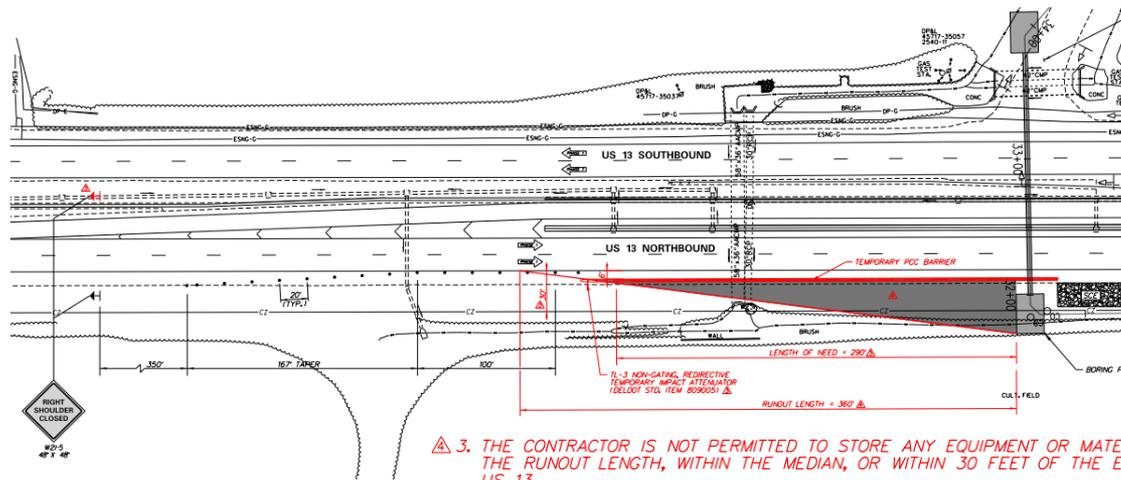
- Crossroad Pipe Installation

- If the existing roadway is not wide enough to maintain a 10' travel lane during construction, provide an MOT Typical Section showing how traffic will be maintained.



Site-Specific MOT Plans and Details

- Temporary Traffic Barrier
 - See DE MUTCD Part 6 and DGM 1-21
 - Provide length of Need (LON) calculations
 - Identify the runout area and specify no storage of equipment or materials in this area
 - Consider pinned barrier if working < 5 ft behind the barrier
 - Dimension the barrier offset from the edge of travel lane
 - Provide typical sections anytime barrier is used



△ 3. THE CONTRACTOR IS NOT PERMITTED TO STORE ANY EQUIPMENT OR MATERIALS WITHIN THE LIMITS OF THE RUNOUT LENGTH, WITHIN THE MEDIAN, OR WITHIN 30 FEET OF THE EXISTING TRAVEL LANES ALONG US 13.

Site-Specific MOT Plans and Details

- Work at Intersections
 - Consider right-turning paths when working around channelizing islands
 - Temporary truck detours may be needed
 - Sequence intersection work to minimize MOT
 - Review “[Temporary Traffic Control within Intersections](#)” Memo on DE MUTCD webpage, updated May 17, 2022
 - Consider turning restrictions and side street restrictions to reduce conflict points during active intersection work
 - Temporary signal plans and temporary timesheets may be required

Pedestrian MOT

Don't forget about pedestrians and bicyclists!

DE MUTCD

Page 6D-1

CHAPTER 6D. PEDESTRIAN AND WORKER SAFETY

Section 6D.01 Pedestrian Considerations

Support:

01 A wide range of pedestrians might be affected by TTC zones, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path. Considerations for pedestrians with disabilities are addressed in Section 6D.02.

Standard:

02 The various TTC provisions for pedestrian and worker safety set forth in Part 6 shall be applied by knowledgeable (for example, trained and/or certified) persons after appropriate evaluation and engineering judgment.

03 Advance notification of sidewalk closures shall be provided by the maintaining agency.

04 **If the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.**

Option:

05 If establishing or maintaining an alternate pedestrian route is not feasible during the project, an alternate means of providing for pedestrians may be used, such as adding free bus service around the project or assigning someone the responsibility to assist pedestrians with disabilities through the project limits.

Alternate pedestrian facilities required if existing pedestrian facilities are impacted



Pedestrian MOT

- Sidewalk Work – Midblock
 - TA-28 Sidewalk Detour
 - Directs peds to the other side of the street using a parallel sidewalk system
 - Requires development of a pedestrian detour plan approved by DelDOT Traffic for detours along state-maintained roadways
 - Detours should not add more than $\frac{1}{4}$ mile to a pedestrian's normal route as they are unlikely to follow the detour



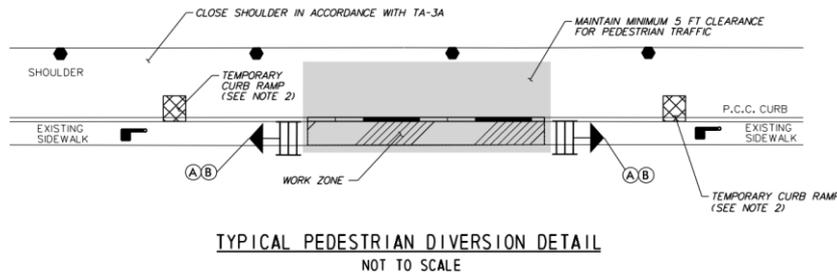
06 It must be recognized that pedestrians are reluctant to retrace their steps to a prior intersection for a crossing or to add distance or out-of-the-way travel to a destination.

Pedestrian MOT

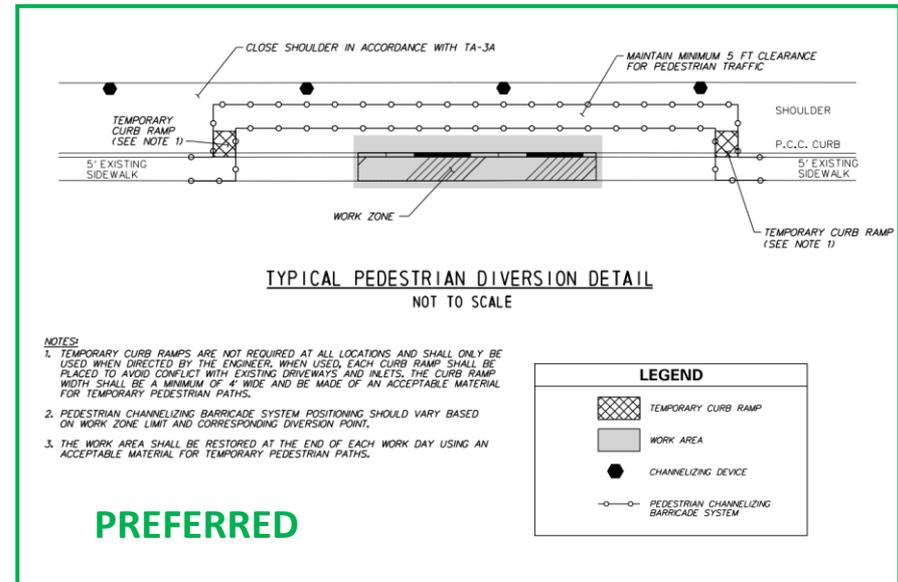
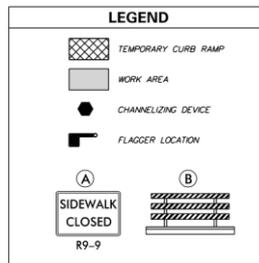
- Sidewalk Work – Midblock

- TA-28 Sidewalk Diversion

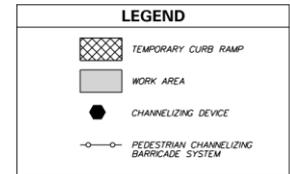
- Directs peds out of the normal sidewalk path and into a closed shoulder or closed travel lane
- Positive protection, such as concrete safety barrier, may be required depending on vehicular travel speeds and duration



- NOTES:**
1. DURING SIDEWALK CLOSURES THE CONTRACTOR SHALL PROVIDE FLAGGERS EXCLUSIVELY FOR PEDESTRIAN MOT.
 2. TEMPORARY CURB RAMPS ARE NOT REQUIRED AT ALL LOCATIONS AND SHALL ONLY BE USED WHEN DIRECTED BY THE ENGINEER. WHEN USED, EACH CURB RAMP SHALL BE PLACED TO AVOID CONFLICT WITH EXISTING DRIVEWAYS AND INLETS. THE CURB RAMP WIDTH SHALL BE A MINIMUM OF 4' WIDE AND BE MADE OF AN ACCEPTABLE MATERIAL FOR TEMPORARY PEDESTRIAN PATHS.
 3. BARRICADE POSITIONING SHOULD VARY BASED ON WORK ZONE LIMIT AND CORRESPONDING DIVERSION POINT.
 4. THE WORK AREA SHALL BE RESTORED AT THE END OF EACH WORK DAY USING AN ACCEPTABLE MATERIAL FOR TEMPORARY PEDESTRIAN PATHS.

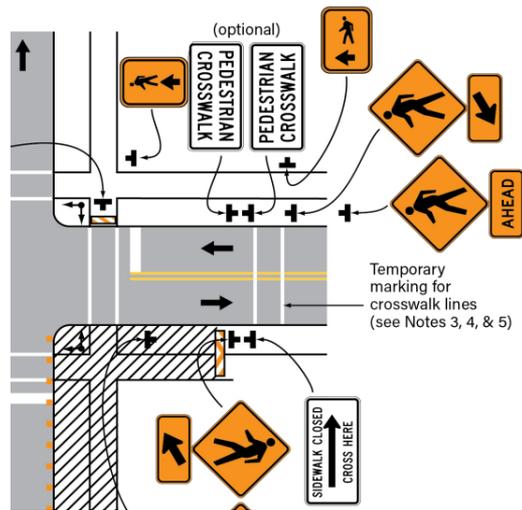


- NOTES:**
1. TEMPORARY CURB RAMPS ARE NOT REQUIRED AT ALL LOCATIONS AND SHALL ONLY BE USED WHEN DIRECTED BY THE ENGINEER. WHEN USED, EACH CURB RAMP SHALL BE PLACED TO AVOID CONFLICT WITH EXISTING DRIVEWAYS AND INLETS. THE CURB RAMP WIDTH SHALL BE A MINIMUM OF 4' WIDE AND BE MADE OF AN ACCEPTABLE MATERIAL FOR TEMPORARY PEDESTRIAN PATHS.
 2. PEDESTRIAN CHANNELIZING BARRICADE SYSTEM POSITIONING SHOULD VARY BASED ON WORK ZONE LIMIT AND CORRESPONDING DIVERSION POINT.
 3. THE WORK AREA SHALL BE RESTORED AT THE END OF EACH WORK DAY USING AN ACCEPTABLE MATERIAL FOR TEMPORARY PEDESTRIAN PATHS.



Pedestrian MOT

- Sidewalk Work – Crosswalk Closure / Curb Ramp Work
 - TA-29 Crosswalk Closures and Pedestrian Detours
 - Temp Midblock Crossings
 - Discouraged on uncontrolled approaches on higher speed and higher volume roadways
 - Require approval by DeIDOT Traffic when used on state-maintained roadways
 - May be appropriate in in urban areas with lower vehicular speeds
 - See NCHRP Report 562 for guidance



3. Temporary midblock crosswalks across uncontrolled approaches are discouraged and shall not be used on state-maintained roadways unless approved by DeIDOT Traffic.
4. If approved by DeIDOT Traffic, temporary midblock crosswalks across uncontrolled approaches shall be installed based on the requirements and guidelines in Parts 2 and 3.
5. Curb parking shall be prohibited for at least 50 feet in advance of the temporary midblock crosswalk.

Pedestrian MOT

- Sidewalk Work – Midblock or Crosswalk Closure / Curb Ramp Work
 - Use a temporary pedestrian path around the work area
 - Ensure use of acceptable materials for temporary ped paths
 - See standard MOT note #13 for acceptable materials
 - See standard construction detail M-13
 - May require a temporary construction easement (TCE) if the temp path is outside of DelDOT ROW
 - Safety fence may be needed to separate the ped path from the work area
 - Safety fence is not an approved method for providing a detectable ped path



Pedestrian MOT

NON-COMPLIANT PEDESTRIAN MOT



Pedestrian MOT

COMPLIANT PEDESTRIAN MOT



Pedestrian MOT

- Construction Phasing

- How the project can be phased to minimize the impact to peds and other road users? Consider...
 - Using materials with quick cure times, such as high early concrete
 - Phasing the work in a manner that allows existing ped facilities to be maintained while the new facilities are constructed
 - Contractor productivity since ped traffic must be maintained at all times



Pedestrian MOT

- Resources

- DE MUTCD Part 6

- https://deldot.gov/Publications/manuals/de_mutcd/index.shtml

- Temporary Traffic Control for Pedestrians Guidelines and Best Practices

- https://deldot.gov/Publications/manuals/de_mutcd/pdfs/TemporaryTrafficControlforPedestrians.pdf

- 2011 Delaware MUTCD Training

- https://deldot.gov/Publications/manuals/de_mutcd/pdfs/draft/DEMUTCD_Part6_T2_training_031611.pdf

Detour Plans

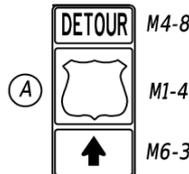
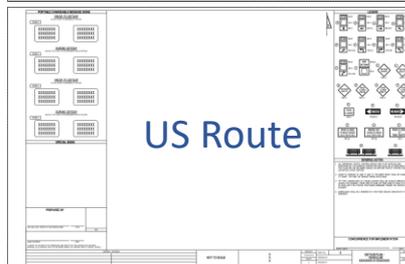
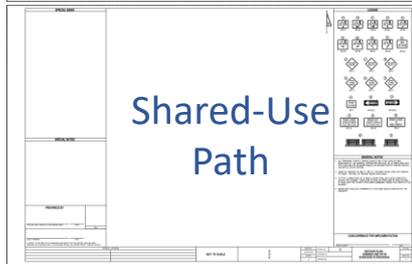
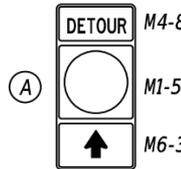
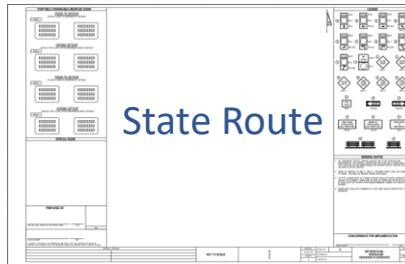
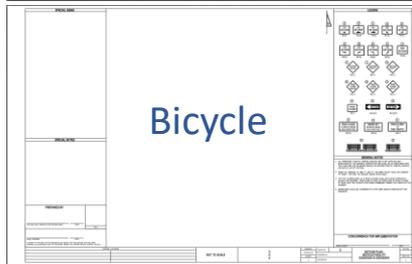
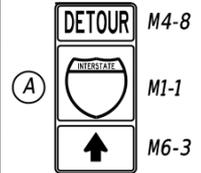
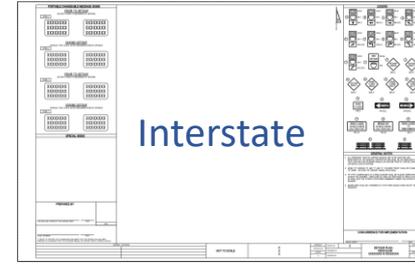
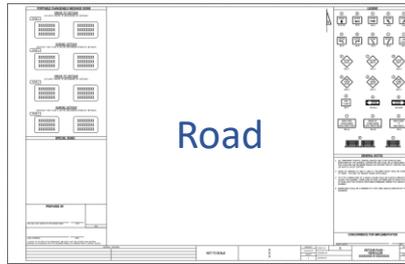
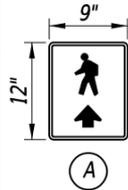


Detour Plans

- Determine the Need
- Plan Development
 - Frequently Seen Errors
- Detour Duration Meeting
- Plan Submission and Review Process
 - The final detour plan containing Traffic Safety's signature of concurrence must be in the plan set prior to Final Entrance Plan approval

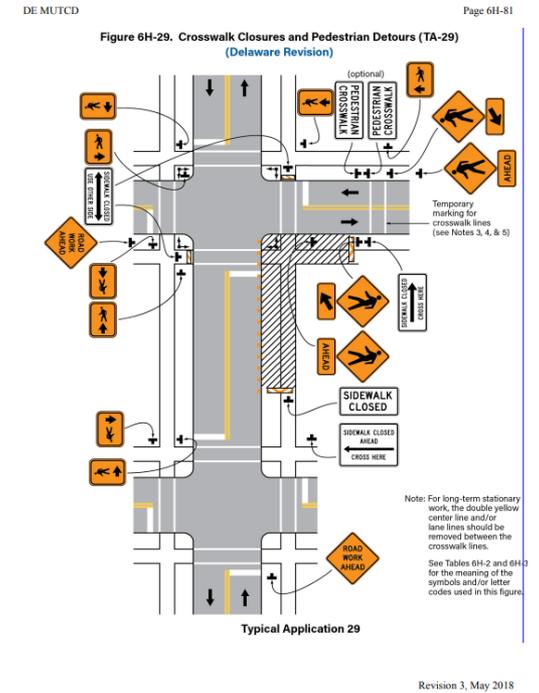
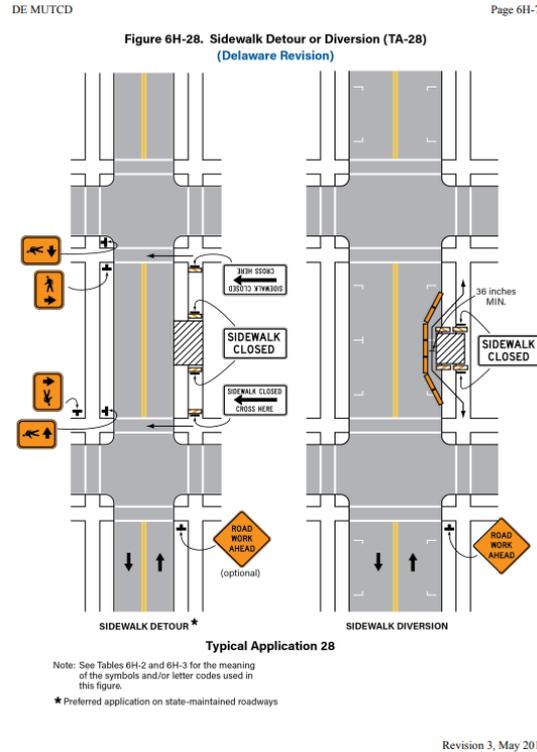
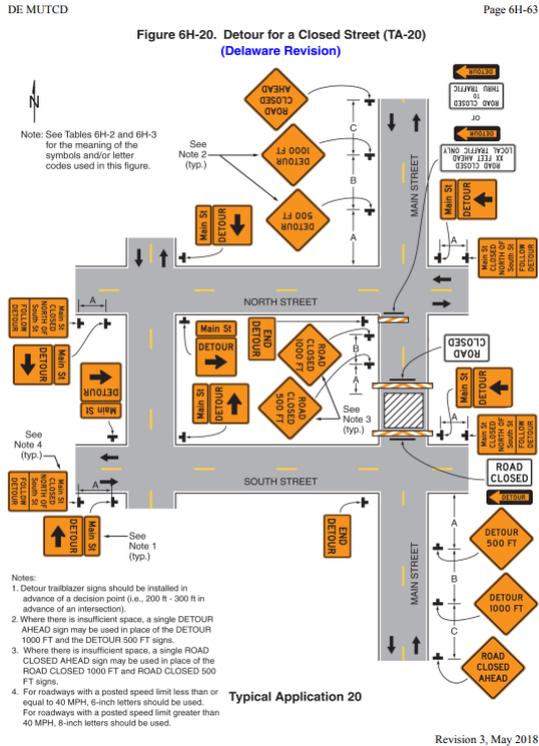
Detour Plans

- Plan Development
 - Use the correct, current standard border



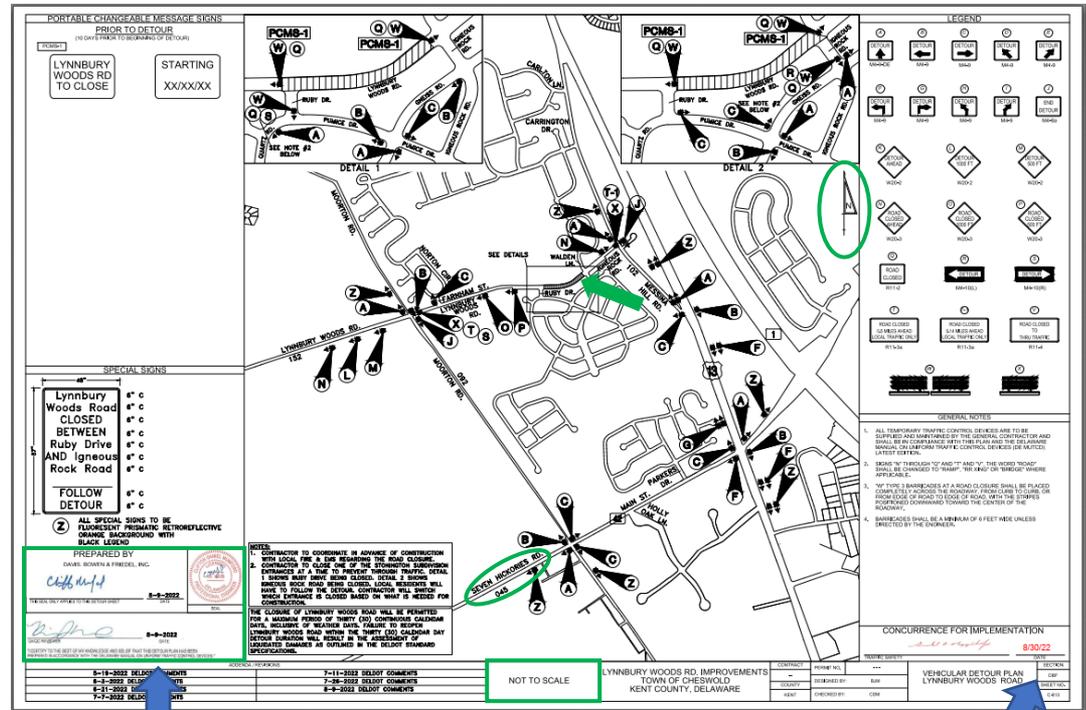
Detour Plans

- Plan Development
 - Refer to TA-20, 28, and 29 for general guidance



Detour Plans

- Detour Plan Checklist
 - Use correct, updated borders
 - North arrow
 - Complete “Prepared By” block
 - Complete QA/QC block
 - Use a map with all roads labeled; use route numbers and symbols, if applicable
 - Detour plans are “NOT TO SCALE”
 - Fill out entire title block
 - If using signs on an interstate/freeway/expressway, add a sheet with those signs dimensioned and labeled
 - Hatch/shade area of closure
 - When using an inset, label all roads



The person preparing the plan should be different than the person QA/QC-ing the plan

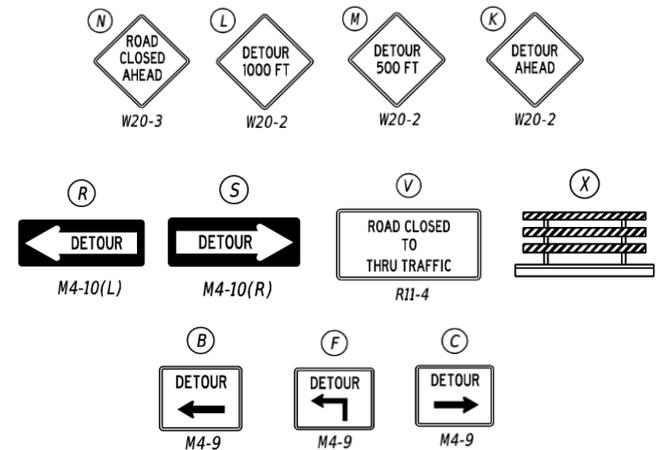
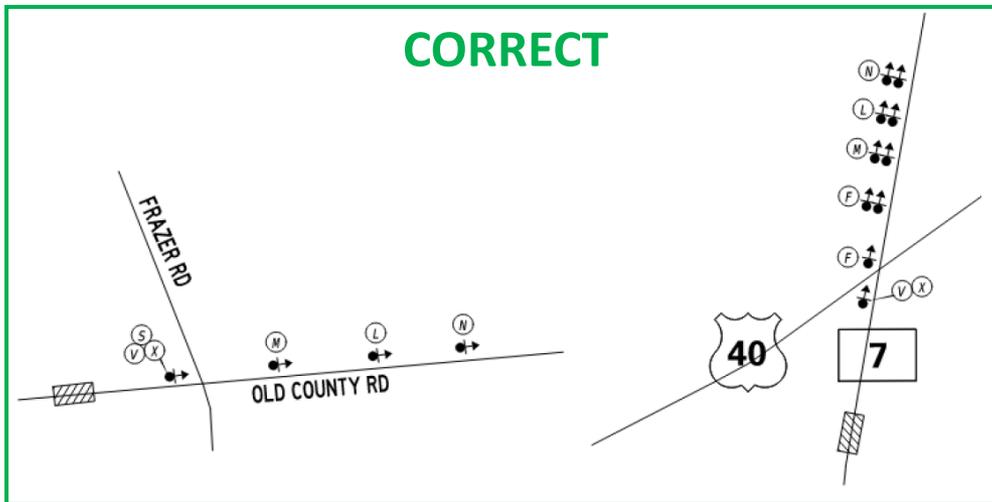
Section = Initials of design firm preparing the plan

Detour Plans

- Frequently Seen Errors

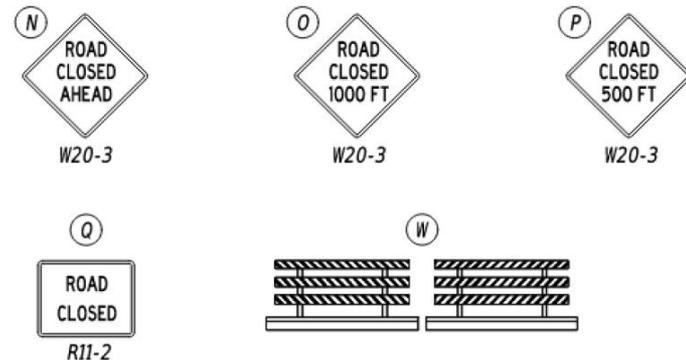
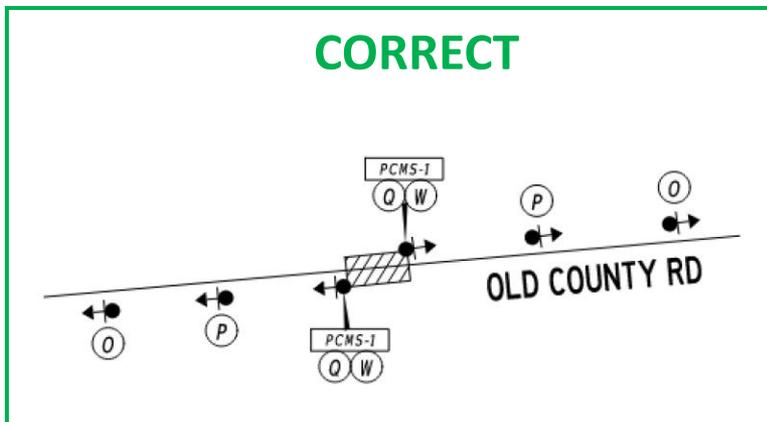
- Incorrect signing on the road being closed

- Use N L M stack, not special signs
 - If there is insufficient space for L & M, use K instead
- Use R or S with V X, not B or C
 - If V X is on a multi-lane highway, or would otherwise be difficult for the driver to see, use B, F, or C



Detour Plans

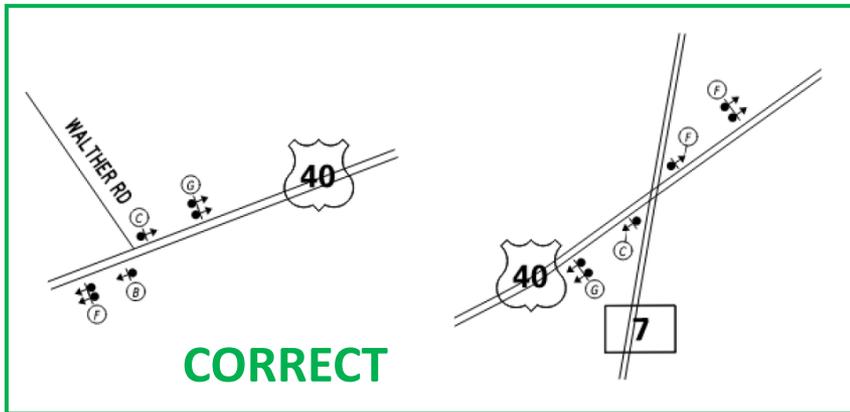
- Frequently Seen Errors
 - Adding unnecessary O, P, N, L, M signs – only use where required
 - Place O & P on the closed road in advance of the Q W
 - If there is insufficient space for O & P, use N instead



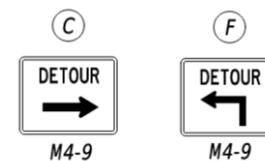
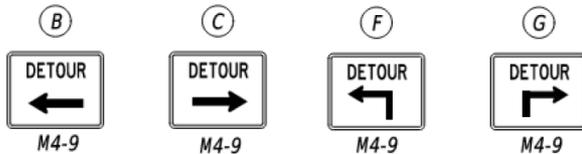
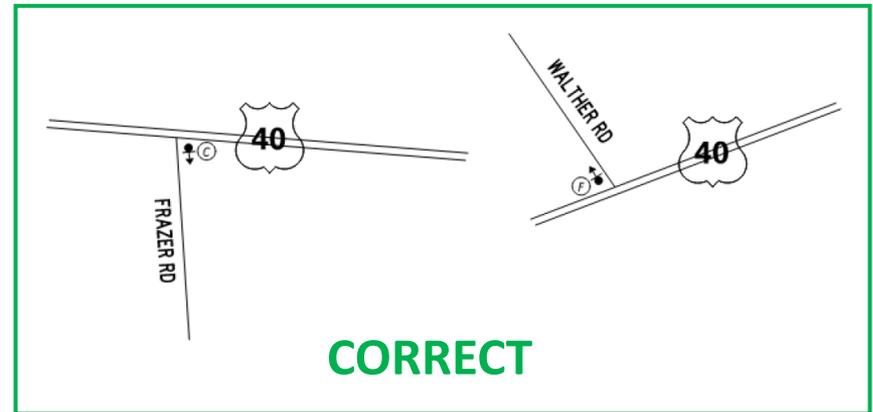
Detour Plans

- Frequently Seen Errors
 - Incorrect advance turn signing at multi-lane roads with a median

FROM A MULTI-LANE ROAD



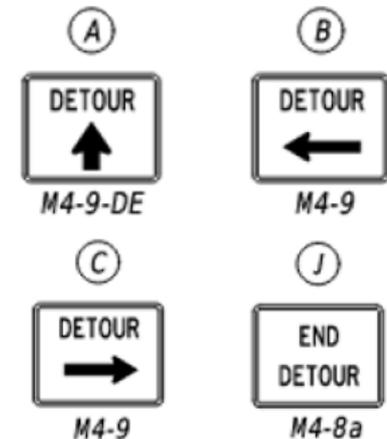
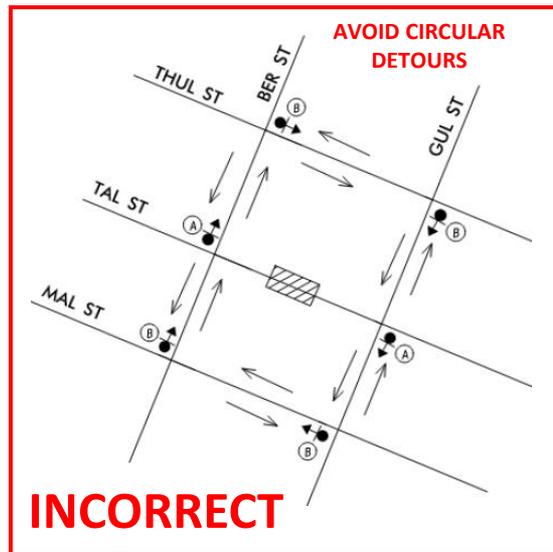
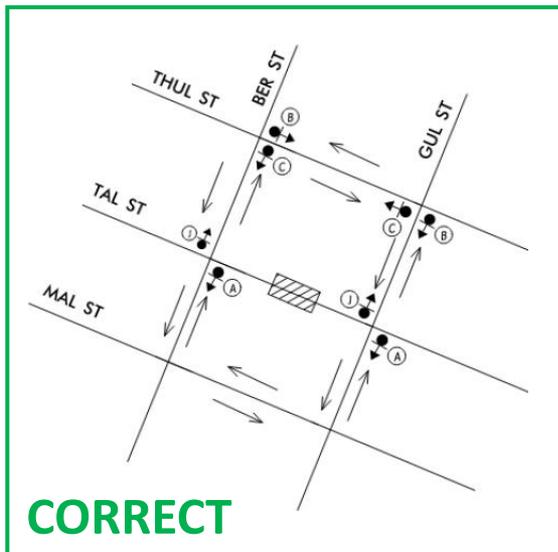
ONTO A MULTI-LANE ROAD



Detour Plans

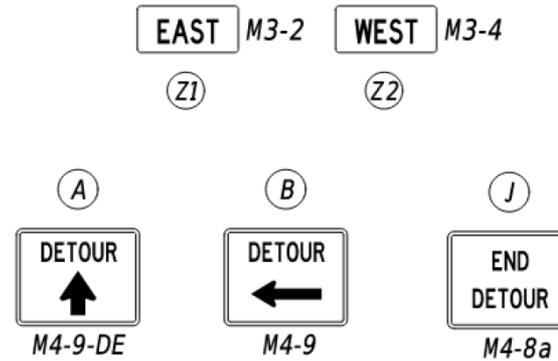
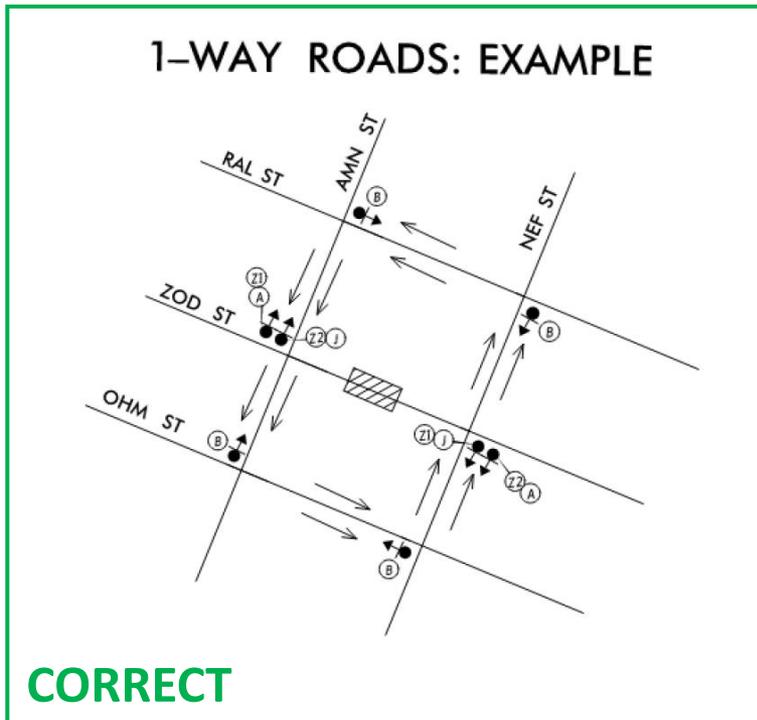
- Frequently Seen Errors

- Creating several detour routes/options. Instead, choose one suitable detour path and use that path for both directions.
- Exception: Detours on or near one-way roads or other unusual road patterns



Detour Plans

- Frequently Seen Errors
 - When deviating from one detour route, use cardinal direction plaques with the detour signs



Detour Plans

- Frequently Seen Errors

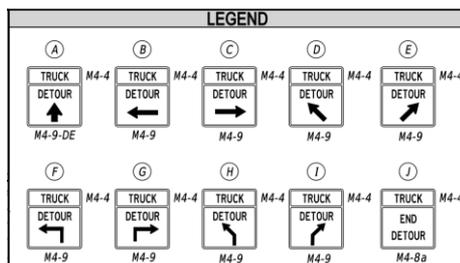
- Failure to accommodate trucks

- If trucks can use the road being closed, the detour route must accommodate trucks

- Engineer shall verify that detour routes are suitable for trucks

- It is preferable to use a detour route that accommodates trucks and cars. However, if the route that accommodates trucks is several miles longer than one that accommodates cars then separate “vehicular” and “truck” detour plans should be developed

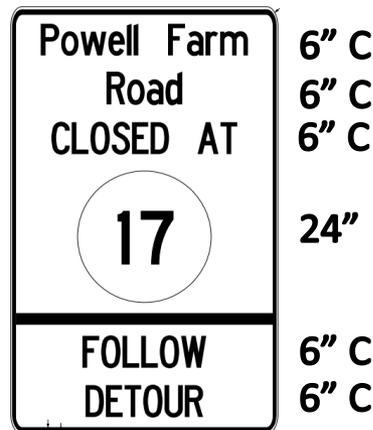
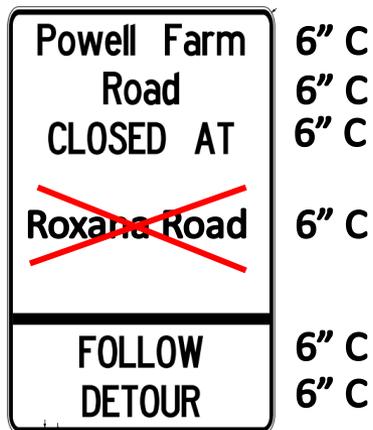
- On truck detour plans, add a M4-4 TRUCK plaque to all detour signs



Detour Plans

- Frequently Seen Errors

- Detouring traffic onto non state maintained roads
 - Detour routes should only use state maintained roads unless there is no other option available
- Not using route symbols with detour signs and special signs
 - Route numbers always take priority over road names



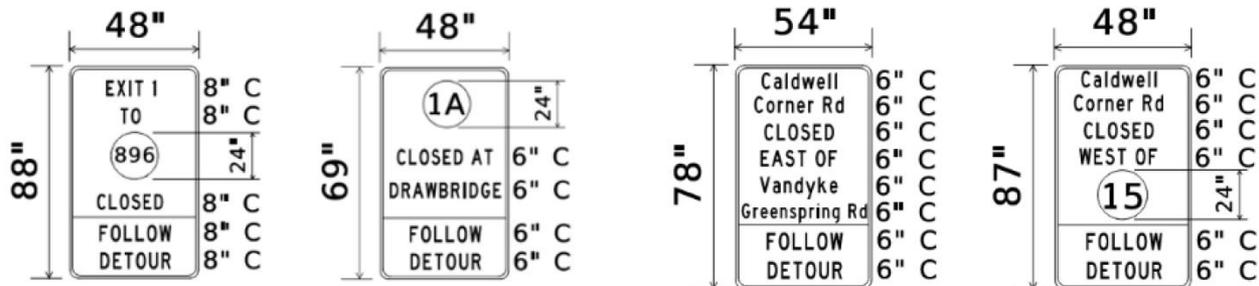
COLORS - LEGEND, BORDER - BLACK
BACKGROUND - RETROREFLECTIVE PRISMATIC FLUORESCENT ORANGE
- ROUTE SHIELD - WHITE BACKGROUND; BLACK LEGEND

Detour Plans

- Frequently Seen Errors

- Incorrect design of special signs

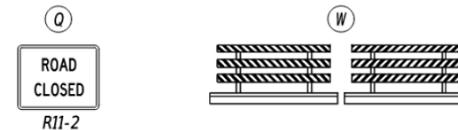
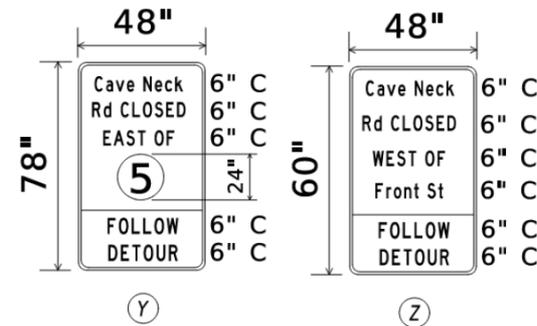
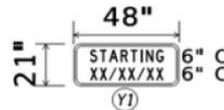
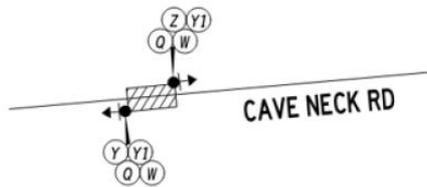
- Signs are typically 48" wide with 11 characters max per row, including spaces
 - Width can be increased to 54" or 60" to accommodate more characters per row
 - Use 6" C lettering, 100% spacing ratio
 - Use 3" spacing between each row, including top and bottom
 - Capitalize all letters of words, except road names (use uppercase/lowercase)
 - FHWA sign design link
 - https://mutcd.fhwa.dot.gov/knowledge/hwy_sign_calculator/index.cfm



Detour Plans

- Frequently Seen Errors

- Failure to see if a PCMS will fit at the road closure area
 - Reasons PCMS may not fit: no shoulder/ROW, trees/shrubbery/landscaping, sidewalk, side slope is too steep
 - If PCMS does not fit, use plaque to be placed over the special sign and include note on how to display the sign and plaque



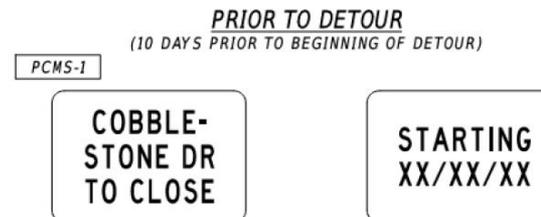
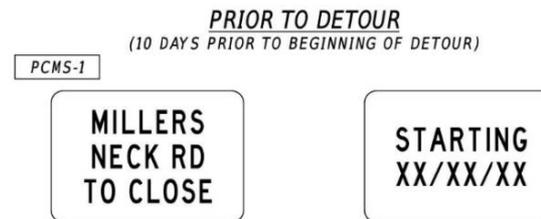
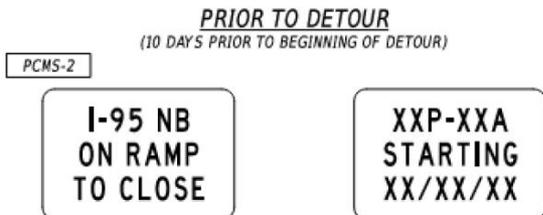
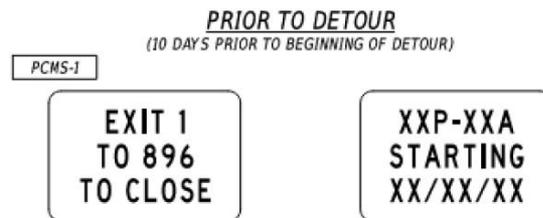
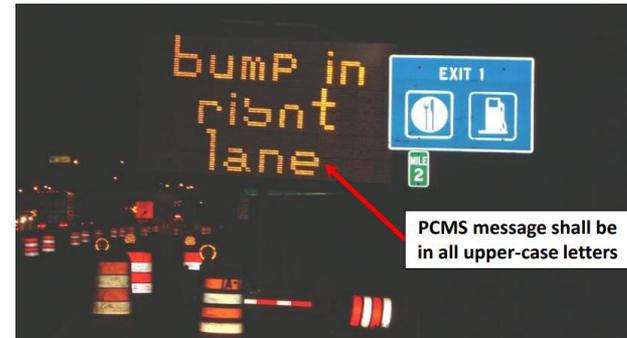
*DISPLAY (Y) & (Z), ALONG WITH THE (Y) PLAQUE, FOR 10 DAYS PRIOR TO THE IMPLEMENTATION OF DETOUR. (Y) PLAQUE TO COMPLETELY COVER "FOLLOW DETOUR" LEGEND ON (Y) & (Z) SIGNS. UPON IMPLEMENTATION OF DETOUR, REMOVE (Y) PLAQUE FROM (Y) & (Z) SIGNS AND RELOCATE (Y) & (Z) TO A LOCATION OUTSIDE OF CLOSURE AREA.

Detour Plans

- Frequently Seen Errors

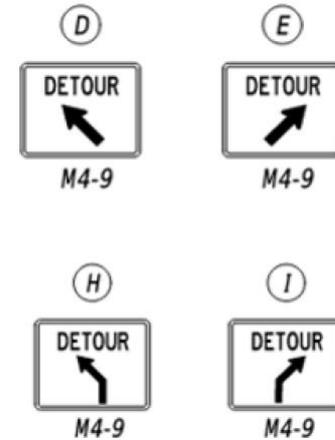
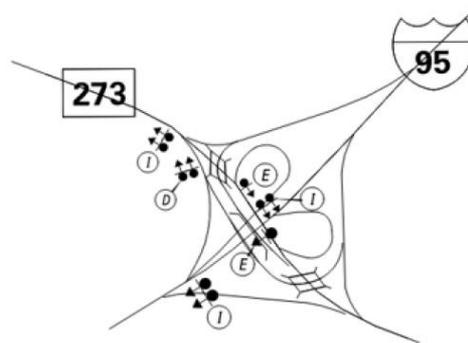
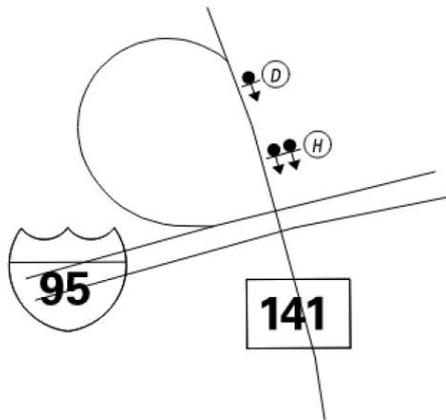
- Incorrect text on PCMS

- Use all capital letters
 - 8 characters max per row
 - 3 rows max per board
 - Messages on PCMS should consist of no more than two phases



Detour Plans

- Frequently Seen Errors
 - Incorrect signing of on/off ramps
 - Use directional signs I, E, H and/or D

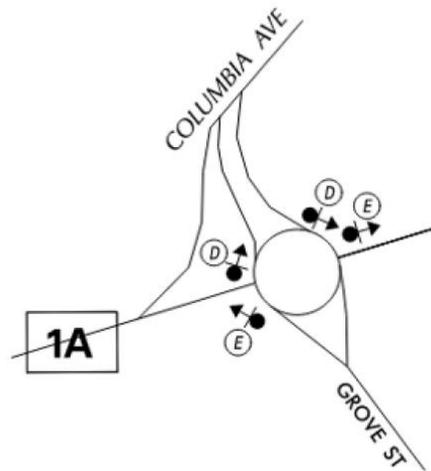
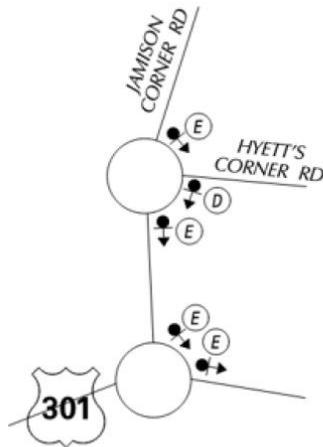


Detour Plans

- Frequently Seen Errors

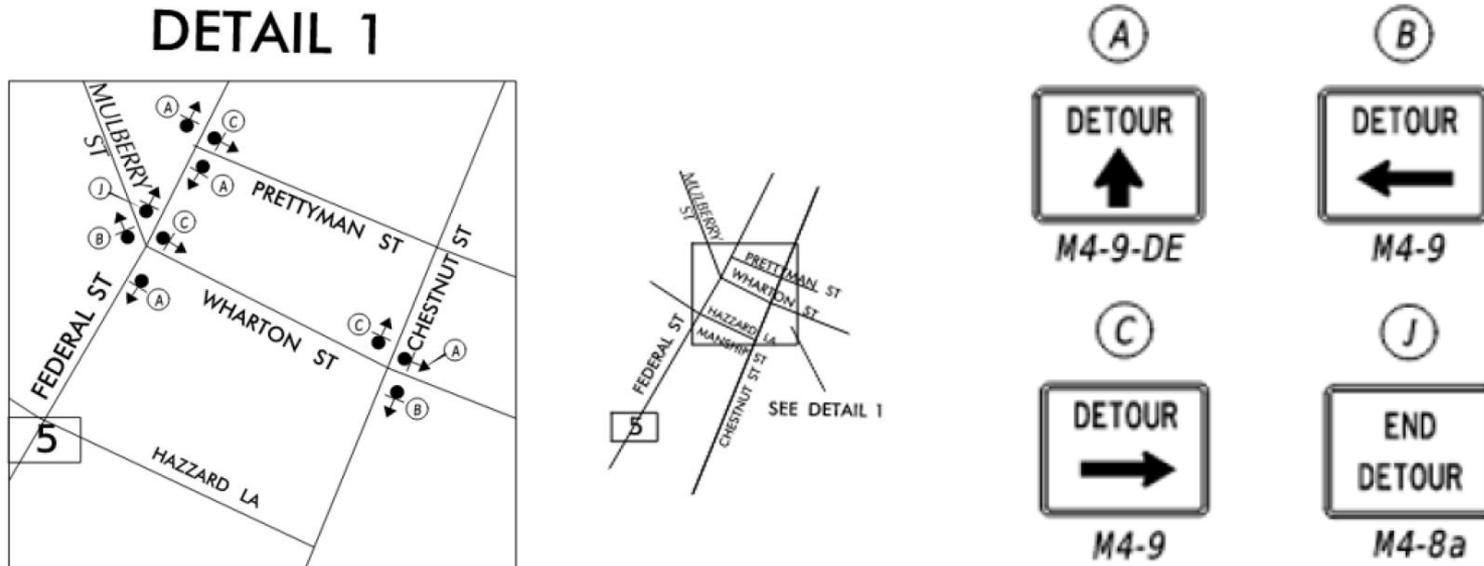
- Incorrect signing of roundabouts

- Use directional signs D and E to navigate through the roundabout



Detour Plans

- Frequently Seen Errors
 - Crowding too many signs into a small area
 - Instead, use an enlarged detail/inset



Detour Plans

- Detour Duration Meeting

- Contact danielle.pollet@delaware.gov to schedule a meeting with the Designer, Traffic Safety, and Public Works to determine the permitted detour duration
 - Designer may invite Owner, Contractor, etc. to attend the meeting
- All detour plans must contain the following standard note(s) prior to Traffic Safety signature of concurrence
 - Liquidated Damages Note: The closure of **Road Name** will be permitted for a maximum period of **X (number)** continuous calendar days, inclusive of weather days. Failure to reopen **Road Name** within the **X (number)** calendar day detour duration will result in the assessment of liquidated damages as outlined in the DeIDOT Standard Specifications.
 - Seasonal Restriction Note: Language varies (add only when directed by DeIDOT Traffic Safety)

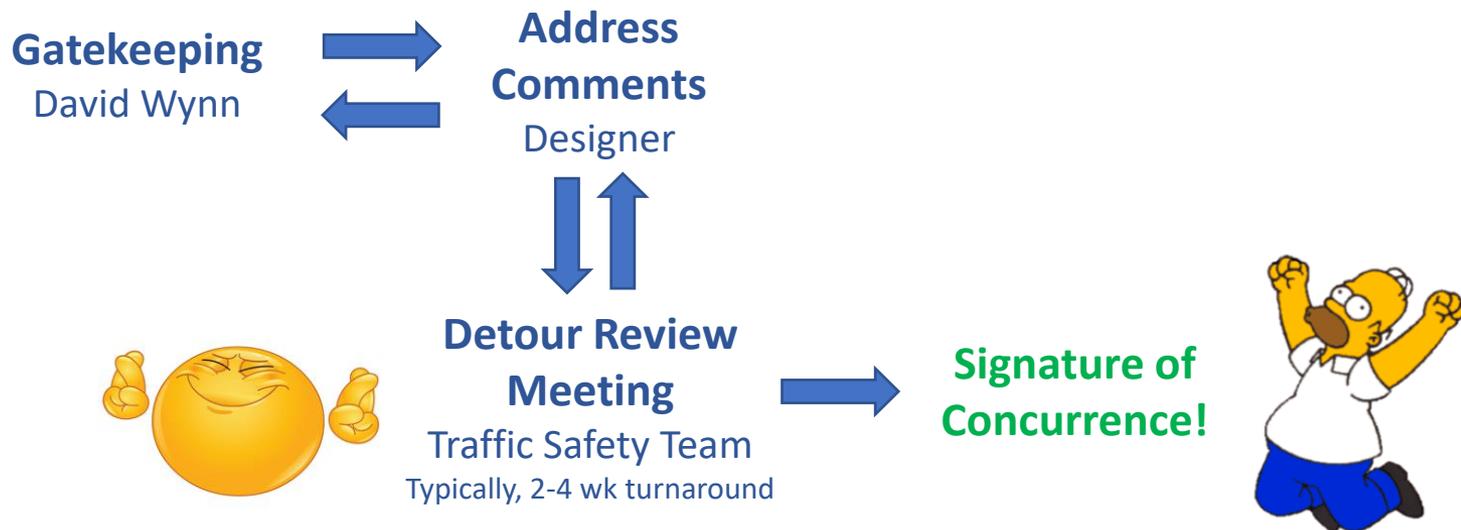
SPECIAL NOTES	
5.	SEE SHEET III OR SPECIAL SIGNS DETAIL.
6.	VEHICULAR AND TRUCK DETOURS SHALL BOTH OPERATE CONCURRENTLY.
7.	VEHICULAR AND TRUCK DETOUR SIGNS IN THE SAME LOCATION SHALL BE POSTED SIDE BY SIDE.
8.	VEHICULAR AND TRUCK DETOUR PLAN FOR POWELL FARM RD @ SR 17 SHALL NOT OCCUR DURING THE SUMMER MONTHS STARTING ON FRIDAY BEFORE MEMORIAL DAY THROUGH LABOR DAY.
9.	THE CLOSURE OF POWELL FARM RD @ SR 17 WILL BE PERMITTED FOR A MAXIMUM PERIOD OF 14 CONTINUOUS CALENDAR DAYS, INCLUSIVE OF WEATHER DAYS. FAILURE TO REOPEN POWELL FARM RD WITHIN THE 14 CALENDAR DAY DETOUR DURATION WILL RESULT IN THE ASSESSMENT OF LIQUIDATED DAMAGES AS OUTLINED IN THE DELDOT STANDARD SPECIFICATIONS.

Detour Plans

- **Plan Submission**

- Detour plan review takes place outside of the typical plan review process
- Submit all detour plans separately through the Traffic Safety Detour Plan review option in PDCA

- **Review Process**



Guardrail



Guardrail

- Determine the Need
- Standard Construction Details
- Approved Products List
- Design
- Frequently Seen Errors



Guardrail

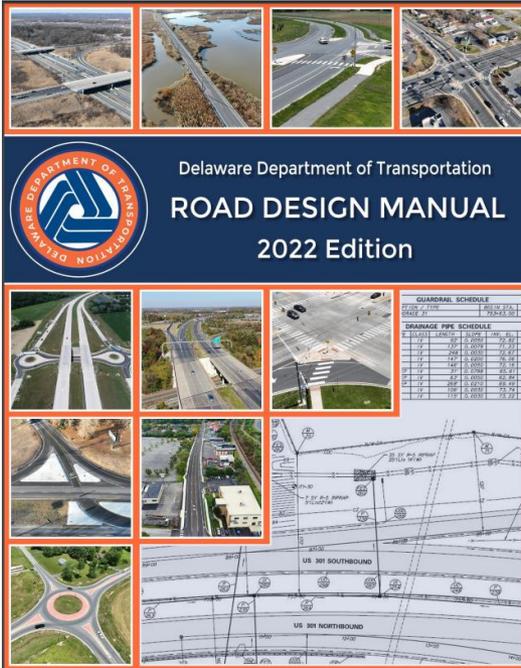
- Determine the Need

3.5.7 Barriers

Reference: AASHTO Green Book Section 4.10; AASHTO RDG Chapters 4, 5, and 6

The purpose of roadside barriers is to reduce fatalities and injuries by preventing a vehicle from leaving the traveled way and striking a fixed object or terrain feature that is less forgiving than striking the barrier itself. The need for barriers is directly related to the selected cross-sectional elements as well as the clear zone and lateral offset concept discussed previously. The need for barrier and its design shall be in accordance with the AASHTO Roadside Design Guide.

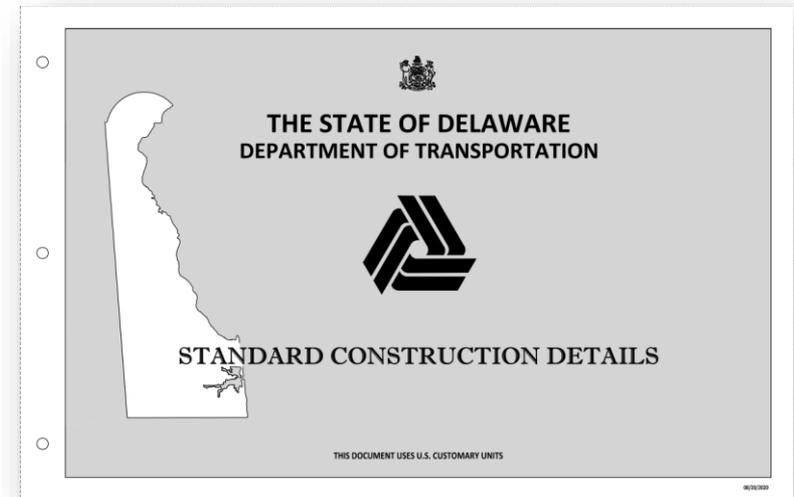
Vehicles impacting the unprotected end of a roadside barrier can result in serious consequences. The vehicles may be stopped abruptly, barrier elements could penetrate the passenger compartment, or the vehicle may become unstable or potentially roll over. A wide variety of devices are used as end treatments and are designed to mitigate vehicle impact with ends of roadside barriers. Proper grading in advance of and in close proximity to end treatments is a critical element in the safe design and installation of end treatments. Additionally, proper curb placement at barriers and barrier end treatments is critical for barriers to function properly. The AASHTO Roadside Design Guide, DelDOT Standard Construction Details, and the DelDOT Standard Specifications shall all be referenced when considering and designing proper end treatments.



Guardrail

Standard Construction Details

- **B-1**: Guardrail Applications
 - Type 1-31, 2-31, 3-31; Plan, Elevation and Section Views
 - Type 1-31 Guardrail with Omitted Post
 - Type 1-31 Guardrail on Steep Slope
- **B-2**: Grading for Guardrail End Treatments (Types 1, 2 and 3)
- **B-3**: Guardrail over Culverts (Types 1-31, 2-31 and 3-31)
- **B-4**: End Anchorage, Type 1-31
- **B-7**: W-Beam, Type 1-27 to Type 1-31 Transition Section
- **B-8**: Guardrail to Barrier Connection – Approach and Exit Type 31
- **B-10**: Guardrail to Barrier Connection – Type 3-31
- **B-13**: Hardware
- **B-15**: Guardrail Applications (Types 1-27, 2-27 and 3-27)
- **B-17**: Guardrail End Treatment, Type 4-27
- **B-18**: Curved Guardrail Section, Type 1-27
- **B-20**: Buried in Back Slope End Terminal, Type 1-31



Standard Construction Details

Guardrail

- Approved Products List

- Guardrail End Treatments and Permanent Impact Attenuators must be on APL to be used on a project

Delaware Department of Transportation Approved Products List
W-Beam Guardrail End Terminals

Standard Item		Manufacturer	Product Name	MASH Test Level	Tangent	Flared	FHWA Eligibility Letter
2001 Standard Specifications	2016 Standard Specifications						
720585	721000	Barrier Systems by Lindsay	MAX-Tension	TL-2	X		CC-134
720585	721001	Barrier Systems by Lindsay	MAX-Tension	TL-3	X		CC-133
720588	721004	Barrier Systems by Lindsay	MAX-Tension Median	TL-3	X		CC-141
720585	721000	Road Systems, Inc.	MASH Sequential Kinking Terminal (MSKT)	TL-2	X		CC-126D
720585	721001	Road Systems, Inc.	MASH Sequential Kinking Terminal (MSKT)	TL-3	X		CC-126, 126A, 126C, CC-126F
720585	721000	Trinity Highway Products, LLC	SoftStop System	TL-2	X		CC-115B, 115E, 115H, 115I
720585	721001	Trinity Highway Products, LLC	SoftStop System	TL-3	X		CC-115, 115A, 115D, 115G, 115H, 115I
720586	721003	Road Systems, Inc.	Flared Energy Absorbing Terminal (MFLEAT)	TL-3		X	CC-143

End terminals not listed above shall not be used on any DelDOT construction contracts without prior written approval from the DelDOT Safety Programs Manager, who is responsible for the above Approved Products List (APL).

All manufacturers and distributors seeking approval for new products must submit a completed copy of the DelDOT APL new product evaluation form, product materials technical data sheet, installation instructions, material safety data sheet, and copies of all related FHWA approval letters.

The ET-Plus® System end terminals manufactured by Trinity Highway Products are not permitted for use on any DelDOT construction contracts.

Delaware Department of Transportation Approved Products List (MASH 2016)
Permanent Impact Attenuators

Standard Item		Manufacturer	Product Name	MASH Test Level	FHWA Eligibility Letter
2001 Standard Specifications	2016 Standard Specifications				
720585	724002	EASI	3-Bay QuadGuard M10 (QG M10) Narrow	TL-2	CC-121, CC-112C
720585	724002	EASI	3-Bay QuadGuard M10 (QG M10) Wide	TL-2	CC-121, CC-112C
720585	724002	EASI	QuadGuard Elite M10; 4-Bay Standard Width	TL-2	CC-112A, CC-112C
720585	724002	EASI	QuadGuard Elite M10; 4-Bay Wide Backup Width	TL-2	CC-112A, CC-112C
720585	724005	EASI	QuadGuard Elite M10; 8-Bay Standard Width	TL-3	CC-112A, CC-112C
720585	724005	EASI	QuadGuard Elite M10; 8-Bay Wide Backup Width	TL-3	CC-112A, CC-112C
720585	724005	EASI	2-Bay to 6-Bay QuadGuard M10 CZ (24", 30" and 36")	TL-3	CC-112B, CC-112C
720585	724005	Energy Absorption Systems, Inc.	6-Bay QuadGuard M10	TL-3	CC-112, CC-112C
720585	724005	Energy Absorption Systems, Inc.	6-Bay QuadGuard M10 Wide	TL-3	CC-112, CC-112C
720517	724006	Work Area Protection	SCI SmartCushion® TL-3 SCI100GM Impact Attenuator	TL-3	CC-128
720585	724002	Lindsay Transportation Solutions, Inc.	Universal TAU-M MASH Crash Cushion	TL-2	CC-146
720585	724005	Lindsay Transportation Solutions, Inc.	Universal TAU-M MASH Crash Cushion	TL-3	CC-147

Approved Products Lists

Guardrail

- Design

- Submit Length of Need (LON) calculations

- LON Resources:

- AASHTO Roadside Design Guide

- FHWA Barrier LON Calculator: <https://highways.dot.gov/federal-lands/safety/barrier-length-need>

Formulas (2011 RDG)

Guardrail runs:

With flare

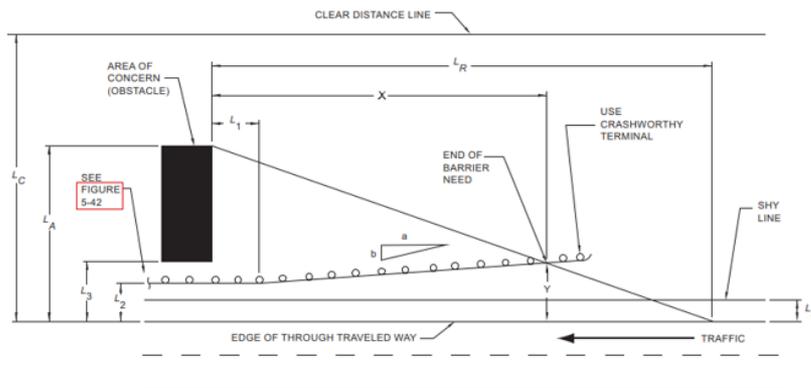
$$X = \frac{L_A + (b/a)(L_1) - L_2}{(b/a) + (L_A/L_R)}$$

No flare

$$X = \frac{L_A - L_2}{L_A/L_R}$$

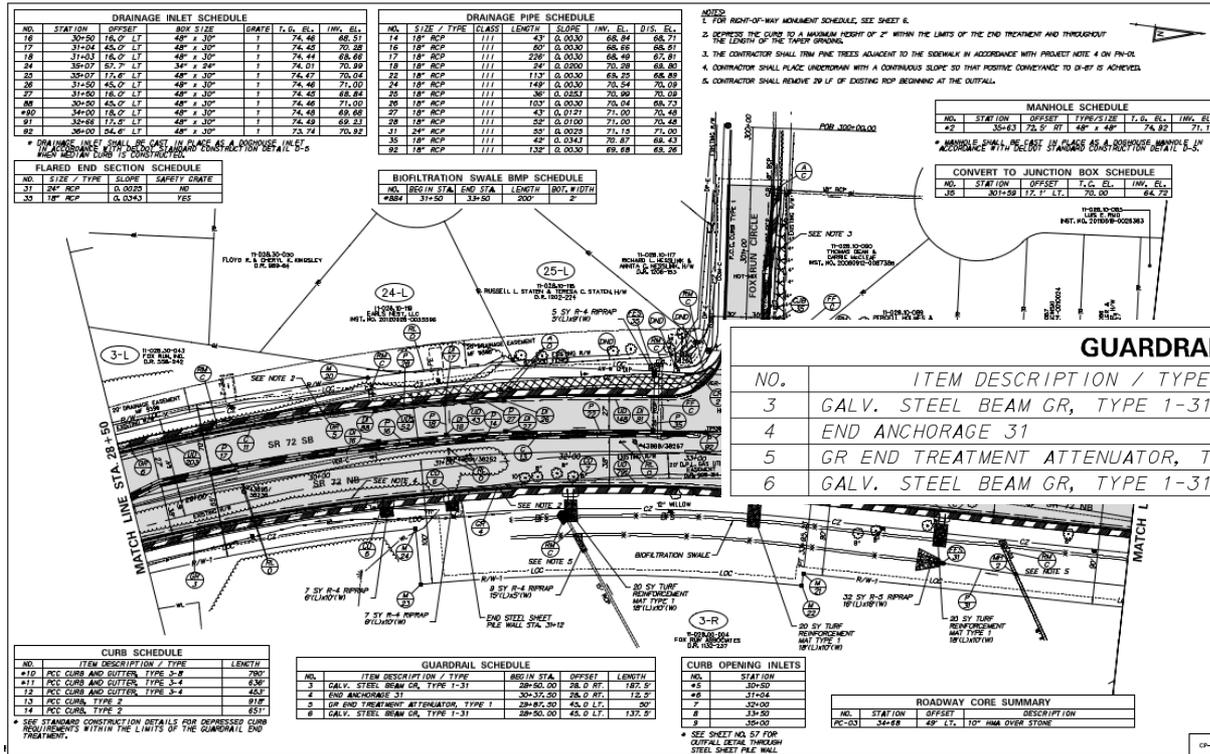
Offset from EOR

$$Y = L_A - \frac{L_A}{L_R}(X)$$



Guardrail

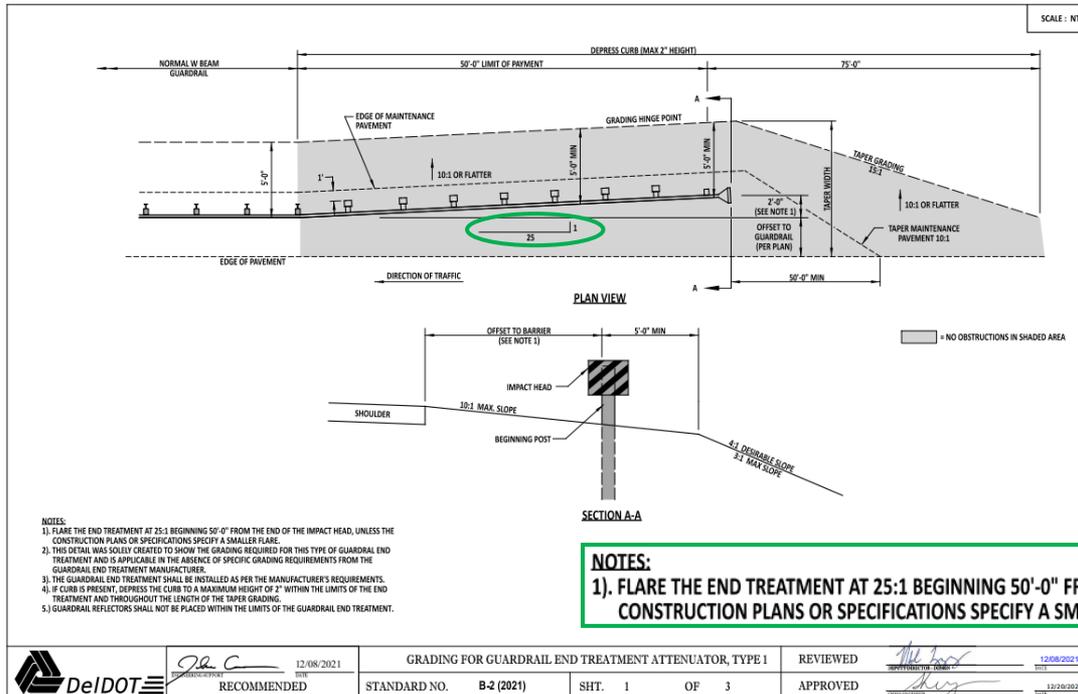
- Design
 - Provide guardrail schedule on construction plans



Guardrail

- Frequently Seen Errors

- Using “with flare” equation for parallel guardrail runs
 - Flare refers to the guardrail run, not the flare of the end treatment attenuator. The flare of the end treatment attenuator should be per the applicable Standard Construction Detail.

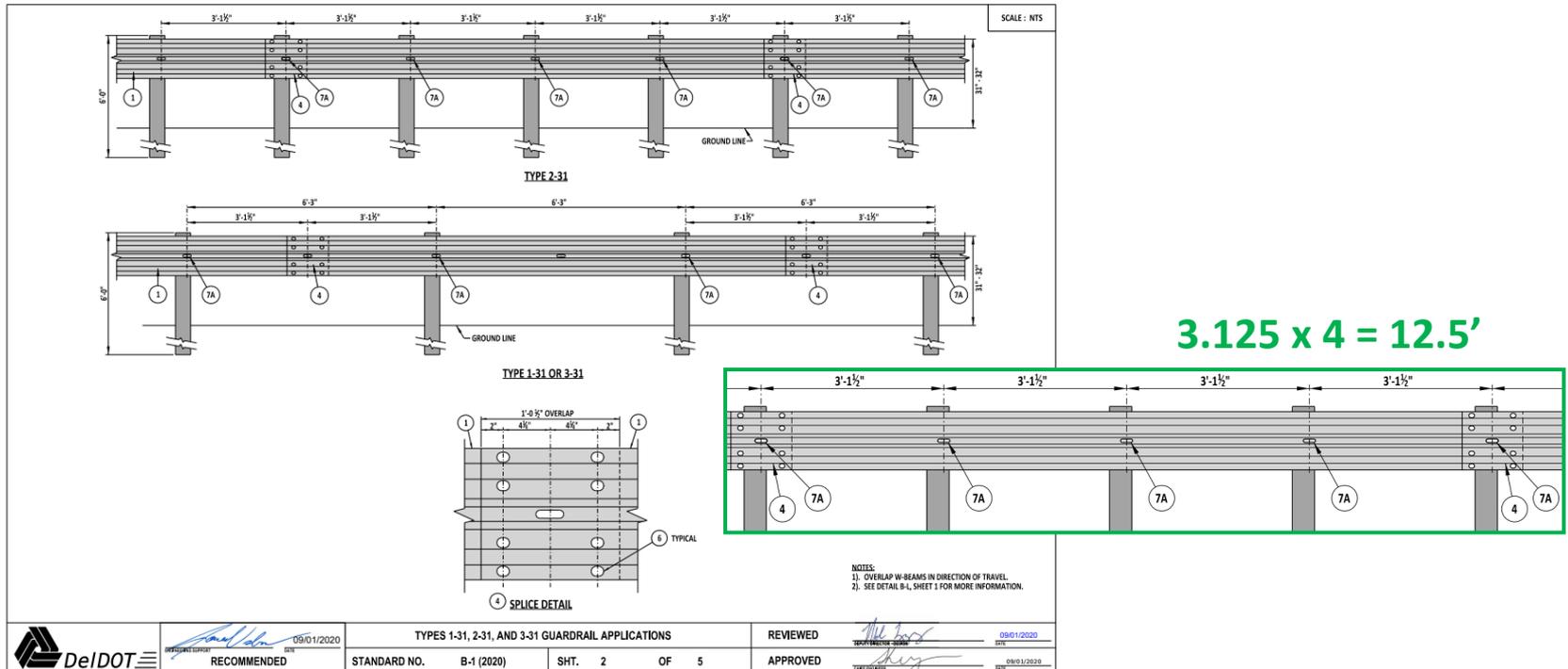


Guardrail

- Frequently Seen Errors

- Incorrect guardrail length

- Guardrail is manufactured in standard 12.5' segments; round up to nearest 12.5' length



Guardrail

- Frequently Seen Errors

- Improper end treatments

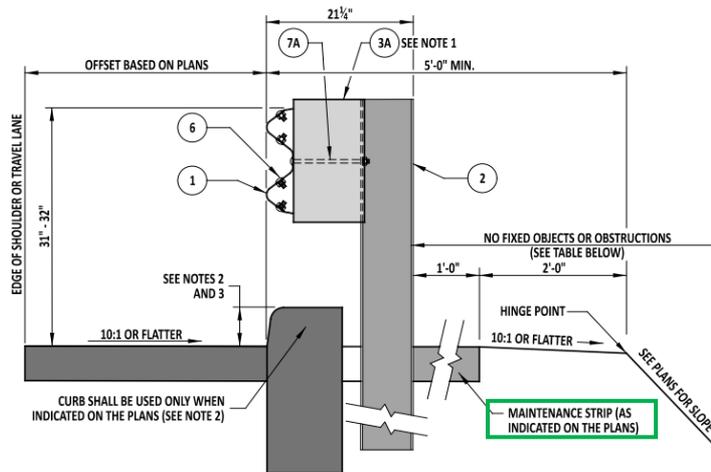
- End treatment attenuators should be used on all undivided roadways even if LON calcs indicate it is not necessary

- Improper grading, offsets, and curb height

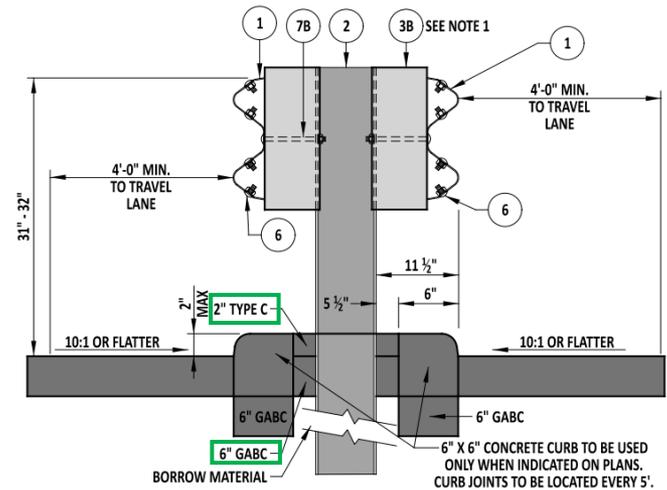
- Design should comply with the Standard Construction Details

- Missing maintenance pavement

- In most cases, maintenance pavement should be provided



1-31 & 2-31 GUARDRAIL SECTION SHOULDER APPLICATION



3-31 GUARDRAIL SECTION MEDIAN APPLICATION

Questions?

WRA MOT Review Team Contact Information

County Reviewers

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